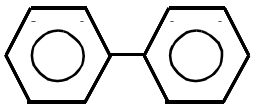
BIPHENYL

Biphenyl is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 92-52-4

Molecular Formula: $C_{12}H_{10}$



Biphenyl is a colorless to yellow leaflet or solid with a pleasant odor. It is soluble in alcohol, ether, benzene, methanol, carbon tetrachloride, carbon disulfide, and most organic solvents. It is insoluble in water. Biphenyl is one of the most thermally stable of all organic compounds (HSDB, 1991). It is combustible at high temperatures (see table below for flash point) producing carbon dioxide and water when combustion is complete. Partial combustion produces carbon monoxide, smoke, soot, and low molecular weight hydrocarbons (SOCMA, 1996).

Physical Properties of Biphenyl

Synonyms: phenylbenzene; xenene; diphenyl; 1,1'-biphenyl; bibenzene

Molecular Weight:	154.20
Boiling Point:	254 - 255 ^{o}C
Melting Point:	69 - 71 ^{o}C
Flash Point:	235 ^{o}F (closed cup)
Vapor Density:	5.31 (air = 1)
Vapor Pressure:	1 mm Hg at 71 ^{o}C
Density/Specific Gravity:	0.991 at 75/4 ^{o}C
Conversion Factor:	1 ppm = 6.3 mg/m^3

(HSDB, 1991; Merck, 1989; Sax, 1989; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Biphenyl is emitted from sources where it is used as an intermediate for polychlorinated biphenyls, in organic synthesis, as a heat transfer agent, in the manufacture of benzidine, and as a dyeing assistant for polyesters (HSDB, 1991). The primary stationary sources that have reported emissions of biphenyl in California are pipelines (except natural gas), and manufacture of electronic components and accessories (ARB, 1997b).

Biphenyl was registered for use as a pesticide, however as of January 1, 1987, it is no longer registered for pesticidal use in California (DPR, 1996).

B. Emissions

The total emissions of biphenyl from stationary sources in California are estimated to be at least 10 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

No information about the natural occurrence of biphenyl was found in the readily-available literature.

AMBIENT CONCENTRATIONS

Biphenyl has a low saturated vapor concentration under conditions of standard temperatures and pressure (10 parts per million; 52.4 milligrams per cubic meter) (SOCMA, 1996). No Air Resources Board data exist for ambient concentrations of biphenyl. No long-term ambient air sampling data is available for biphenyl, however, the results of limited air sampling are available. Ambient air sampling was conducted in Redlands, California on selected days and nights during October 19-28, 1994. A total of seven 12 hour daytime and six 12 hour nighttime samples were collected. The observed 12 hour average ambient concentrations of biphenyl ranged from 10 to 37 nanograms per cubic meter (ng/m^3) (Atkinson, 1995).

In addition, the United States Environmental Protection Agency (U.S. EPA) has compiled information on biphenyl from a location in Columbia, South Carolina that reported ambient concentrations during 1989 ranging from 13.9 to 15.7 ng/m^3 (U.S. EPA, 1993a).

The ambient air concentrations for biphenyl obtained from limited sampling indicate that levels are 30-100 fold lower than the occupational exposure limits established for this material (OSHA PEL: 1000 ng/m^3, ACGIH TLV: 1300 ng/m^3) (SOCMA, 1996).

INDOOR SOURCES AND CONCENTRATIONS

No information about the indoor sources and concentrations of biphenyl was found in the readily-available literature.

ATMOSPHERIC PERSISTENCE

The dominant tropospheric loss process for biphenyl is reaction with the photochemically produced hydroxyl (OH) radical. The calculated half-life and lifetime of biphenyl due to reaction

with the OH radical is estimated to be 1.4 and 2.0 days, respectively. The products observed are 2-hydroxybiphenyl and, in much lesser amounts, 3- and 4-hydroxybiphenyl, and 3-nitrobiphenyl (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

Biphenyl emissions are not reported from stationary sources in California under the AB 2588 program. It is also not listed in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program Revised 1992 Risk Assessment Guidelines as having health values (cancer or non-cancer) for use in risk assessments (CAPCOA, 1993).

HEALTH EFFECTS

Possible routes of human exposure to biphenyl are inhalation, ingestion, dermal, and eye contact (HSDB, 1991).

Non-Cancer: Exposure to biphenyl may cause irritation of the eyes, nose, throat, and respiratory tract. Workers exposed to high vapor concentrations have reported peripheral and central nervous system effects, liver, and kidney injury (HSDB, 1991). Long-term exposure may cause peripheral and central nervous system effects with symptoms including headache, fatigue, tremor, insomnia, sensory impairment, and mood changes (Sittig, 1991).

The U.S. EPA has established an oral Reference Dose (RfD) for biphenyl of 0.05 milligrams per kilogram per day based on kidney damage in rats. The U.S. EPA estimates that consumption of this dose or less over a lifetime would not likely result in the occurrence of chronic non-cancer effects. The U.S. EPA has not established a Reference Concentration (RfC) (U.S. EPA, 1994a).

Limited data indicate that biphenyl does not cause birth defects in animals (U.S. EPA, 1994a).

Cancer: No data are available on the carcinogenic effects in humans. The U.S. EPA has placed biphenyl in Group D: Not classifiable as to human carcinogenicity (U.S. EPA, 1994a). The International Agency for Research on Cancer has not classified biphenyl with respect to potential carcinogenicity (IARC, 1987a).